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Brushless Direct-Current Motors

A survey (see Note) of the development of brushless dc motors shows that they are no longer too expensive for commercial use; the greater cost of the electronic commutator is shrinking with developments in semiconductor technology. Previously, these motors have been used primarily in aerospace and battery-operated equipment, where high degrees of efficiency and reliability are essential.

Such motors, of up to 50 kW and more efficient than any other motor of the same size, can be built for little more than the cost of conventional dc motors. This is especially true if the advantages of the brushless motor are fully utilized: it can be turned on or off, or reversed, by switching of low-power control signals; and the function of expensive, high-power, automatic switches, needed for large conventional motors, can be performed by the electronic commutator. Other advantages are the absence of wear and arcing of conventional commutators (and their associated problems), a high ratio of shaft torque to motor weight, and a convenient means of speed regulation which allows the motor to maintain high efficiency over a wide range in torque.

An experimental brushless motor was built, with each coil terminal having a separate and accessible lead; with the shaft and all electronics excluded, its length and outside diameter measured 1.25 and 0.75 in., respectively. This motor was tested exhaustively varying the connections of the coils, the sensors, and the electronic commutators.

The survey shows how the use of unconventional motor windings and switching sequences can achieve

the advantages claimed, and how medium-sized motors can be built without excessive electronic circuitry. Several types of shaft-position sensors and electronic commutators for various types of brushless motors are considered. Its simple and efficient control of speed may make the brushless dc motor excellent for electric transportation vehicles.

Note:

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Reference:

NASA-CR-106071 (N69-38664), Brushless Direct Current Motors

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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